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INSTRUCTION MANUAL

DIGITAL FUNCTION GENERATOR

Model: TFG-8111

TOPWARD

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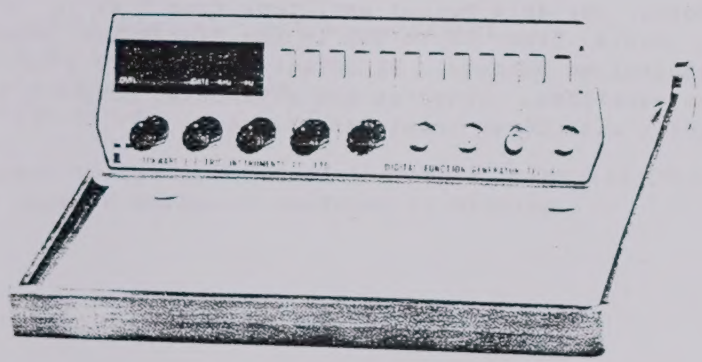
PICTURE of MODEL TFG-8111



INTRODUCTION

The Topward TFG-8111 is a portable, bench type multi-purpose digital function generator/counter capable of producing 5 different waveforms. These are Sine, Square, Triangle, Pulse and Ramp.

The model TFG-8111 features: Adjustable frequency range from 0.1 Hz to 2 MHz in 7 ranges, variable output amplitude from 5 mV to 20 Vp-p, variable symmetry/duty cycle from 5% to 95% in the Ramp/Pulse mode, continuous or externally controlled outputs, DC offset between -10 V to +10 V can be added to all output waveforms, inverted and attenuated output, built-in 100 MHz frequency counter with 25 mV input sensitivity.

BEFORE WE BEGIN

Your Topward TFG-8111 is packed in styrofoam to protect it during shipment. You should keep this material, and the shipping box, in case the unit must be moved or shipped again.

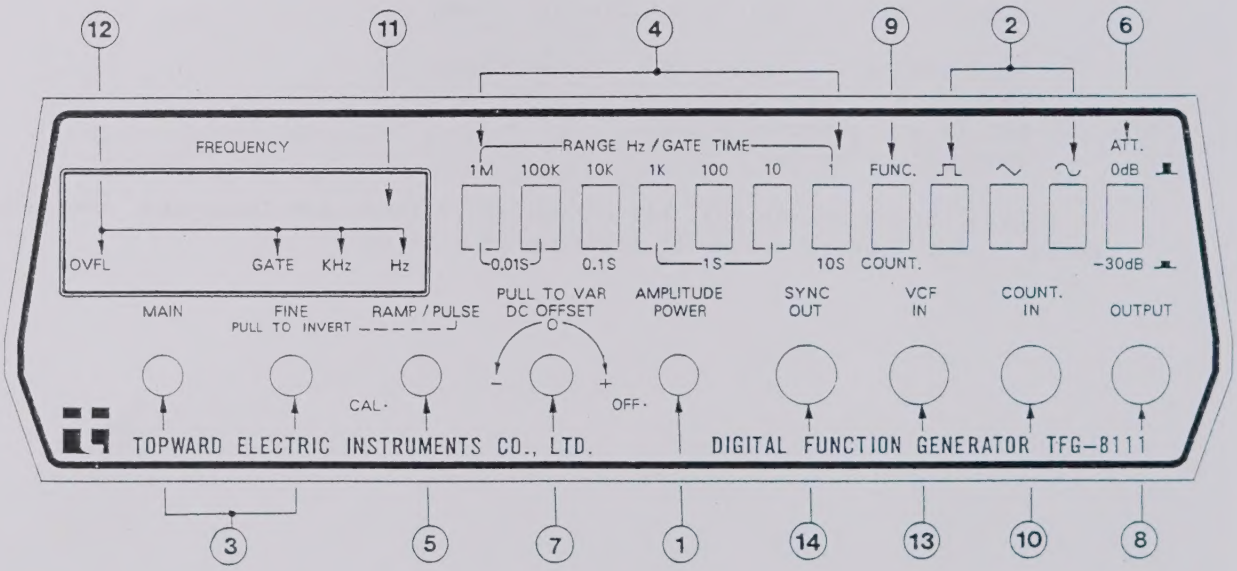
The box should contain the following items:

- Model TFG-8111 Digital Function Generator
- Removable AC line cord
- BNC to alligator clip cable
- Instruction manual

Please check to see that all of the above items are included. You should contact your Topward dealer if anything is missing.

FRONT PANEL of the MODEL TFG-8111

Figure - 1



FRONT PANEL DESCRIPTION

The following is an explanation of the function of the front panel controls and connectors. Please refer to Figure 1 for location of each control/connector.

1. **POWER/AMPLITUDE** - This is the main power switch and the amplitude adjustment knob. Turning the control clockwise will increase the amplitude.

2. **FUNCTION** - This bank of switches is used to select the output waveform. Only one of these switches can be depressed at a time.

3. **FREQUENCY CONTROL** - This pair of knobs is used to adjust the output frequency. The frequency is dependent upon the setting of this pair of knobs and the **RANGE/GATE TIME** switches (4). Pulling out the **FINE** control knob (3) will invert the pulse output.

4. **RANGE/GATE TIME** - This bank of switches is used to select the frequency range produced. At the same time, the counter gate time is changed.

5. **RAMP/PULSE** - This knob is used to adjust the duty cycle of the Square or Triangle waveforms. When the knob is turned to CAL. (fully CCW position), the duty cycle is fixed at 50%. Otherwise, the duty cycle is adjustable between 5 to 95%.

6. ATTENUATOR - When this push button is out, the output/input signal is unchanged. If the switch is depressed, the Output/Input signal is reduced by 30 dB (Generator output / Counter input).

7. DC OFFSET - This knob allows a variable DC voltage between -10 V to +10 V to be added to the output signal. Note that the knob has to be pulled out for the offset to affect the signal. When the control is pushed in, no offset voltage is added.

8. OUTPUT - This connector provides the output signal for all waveforms.

9. FUNC/COUNT - When the switch is out, the 6 digits DISPLAY (11) shows the generator frequency. When the switch is in, the DISPLAY (11) shows the input frequency of counter.

10. COUNTER IN - This is the input connector for the 100MHz frequency counter. FUNC/COUNT switch (9) must be depressed.

11. FREQUENCY DISPLAY - This is a 6 digits LED display that shows the output frequency of the main generator or the input frequency of the counter.

12. INDICATORS - OVFL, GATE, KHz, Hz LEDs enunciate frequency overflow, gate time and frequency units in KHz, Hz.

13. **VCF IN** - This input is used to modulate the main frequency to 1000:1 with an external source of 0 - 5VDC.

14. **SYNC OUT** - This connector supplies a TTL compatible output signal which is unaffected by either the **FUNCTION** (2) or **AMPLITUDE** (1) controls. The output frequency is the same as that of **OUTPUT** signal (8).

OPERATING INSTRUCTIONS

1. **Instrument Turn-on**

   WARNING: Before applying power to your TFG-8111, make sure that the input voltage is set to your power source.

   A. Connect the TFG-8111 to an AC power source and turn on the POWER switch (1).

2. **Main Generator**

   A. Select the desired waveform using the FUNCTION switch (2). To generate a ramp or pulse output, turn on the RAMP/PULSE knob (5) and set the desired duty cycle.

   B. Set the desired frequency with the FREQUENCY control (3) and the RANGE switches (4).

   C. Adjust the output amplitude with the AMPLITUDE control (1) to the desired level. If a very small signal is required, depress the ATTENUATOR switch (6).

   D. Set DC Offset voltage with the DC OFFSET control (7).

   E. Use the SYNC output terminal (14) if TTL compatible level is required.

F. Pull out the INVERT switch (3) to introduce a 180 degree phase shift.

3. Voltage Controlled Frequency
   A. Supply a trim voltage between 0 and 5 VDC to the VCF IN terminal (13). The main frequency will be varied over 1000:1.

4. Frequency Counter
   A. Push in the FUNC/COUNT switch (9).

   B. Apply input signal to COUNT IN (10).

   C. Select GATE TIME (4) for best resolution.

   D. Use ATTANUATOR (6) for large input signal to avoid damage to the instrument.

OPERATING CAUTIONS

To assure operation within the published specifications, allow the unit to warm up and stabilize for at least 20 minutes.

Failure to observe the operating procedure listed below will result in damage to the unit and void your warranty.

Do not supply more than 10 Volts (AC + DC) into:

- Output terminal (8)
- VCF IN terminal (13)
- SYNC terminal (14)

THEORY OF OPERATION

Counter Section

1. Counter Amplifier (refer to circuit diagram sheet 1)

   A. The buffer amplifier (Q3 and Q4) make up the impedance buffer circuit.

   B. U5A-U5C form a secondary high voltage gain stage. Q5 and Q6 form a level shifter.

2. Counter Control Circuit (refer to circuit diagram sheet 4)

   A. U14 (7216D) is a single chip counter IC. U13 and CR38-CR43 form a gate time selecting circuit.

   B. CR44-CR54 form a decimal point selecting circuit and Hz, KHz indicating circuit.

   C. U16A-U16D form a generator frequency display / counter input frequency display selecting circuit.

   D. U15 is a divide-by-ten IC, use for the high frequency input measurement.

Generator Section

1. Tuning Amplifier Summing Amplifier and Constant Current Source (refer to circuit diagram sheet 2)

A. The tuning amplifier is a non-inverting input amplifier (U8A), providing a fixed voltage for frequency control **MAIN** and **FINE** (3). U8B is a voltage buffer IC, buffering the variable control voltage of frequency control **MAIN** and **FINE** (3).

B. The summing amplifier (U6 and Q7) sums each current from the VCF input and the tuning amplifier output. The output voltage of the amplifier is a weighted average of the input signal voltages. The frequency control **MAIN** and **FINE** (3) varies the amount of voltage which determines the generator output frequency.

C. U7 and Q8 generate equalizing positive and negative voltages for the current source circuit. The current source circuit includes positive current source (U9 and Q9) and negative current source (U10 and Q10). The positive and negative current values are determined by frequency control **MAIN** and **FINE** (3).

2. **Triangle Generator and Comparator (refer to circuit diagram sheet 2)**

The triangle waveform from the triangle generator is apply to the voltage comparator which acts as an amplitude limiter. As the triangle waveform alternately crosses the upper and lower switching levels (refer to R47-R50) of the limiter input, a square wave is generated at the output of the voltage comparator (U11). The square is feedback to the triangle generator where it controls the charge / discharge cycle of the triangle output.

3. **Sine Shaper and PRE-Amplifier (refer to circuit diagram sheet 3)**

A. To obtain a sine wave. The triangle wave is shaped by a diode network (CR16 - CR31), in the sine shapper. There are four-stage diodes network serves as a non-linear load which varies the attenuation of the input triangle according to its level.

B. The PRE-Amplifier is a non-inverting closed loop amplifier. Q15 and Q16 form the differential input stage that provides DC stability. Q17 forms the second gain stage. Q18 and Q19 are the output buffer circuit.

4. **Output Amplifier (refer to circuit diagram sheet 3)**

The output amplifier works the same manner as PRE-Amplifier, and provides a 50 ohms low output impedance for OUTPUT terminal (8).

CALIBRATION

CAUTIONS: Services performed by unauthorized person will void your warranty.

To assure the most stable operation possible, your Model TFG-8111 should be periodically adjusted. To perform the following adjustment procedures, you will need a Phillips screwdriver, Timer/Counter, Voltmeter, an Oscilloscope (50MHz minimum), Distortion meter, and high frequency (up to 100MHz) signal generator. Calibration be performed under liboratory conditions having an ambient temperature of 18° to 28°C(62° to 82°F), and relative humidity of less then 80%. As you perform this procedure, please refer to the adjustment location drawing.

1. Set the TFG-8111 controls as follows:

RANGE (4)	1K
FUNCTION (2)	∿
DC OFFSET (7)	OFF
AMPLITUDE (1)	CW (Max.)
RAMP/PULSE (5)	CCW (CAL)
FREQUENCY MAIN & FINE (3)	CW (Max.)

2. Connector OUTPUT (8) on Counter TFC-1201 (or equivalent), adjust R127 (2MHz ADJ) to display 2.3KHz ± 50Hz.

3. Select **RANGE**(4) to 1 K and **FUNCTION** (2) to SINE. Set the **FREQUENCY MAIN & FINE** (3) to read 1KHz on TFC-1201. Connect the **OUTPUT** (8) to a distortion meter TDA-710 (or equivalent). Adjust R130 (SINE DIST1), R131 (SINE DIST2) for minimum distortion.

4. Select **FUNCTION** (2) to TRIANGLE. Turn the **AMPLITUDE** (1) to mid location. Connect the output to an voltmeter. Adjust R135 (PA DC) to be DC ± 10mV. Turn the **AMPLITUDE** (1) to maximum location. Connect the **OUTPUT** (8) to an oscilloscope. Adjust R134 (TRI AMPL) to let the Vp-p of triangle wave be 20 8V ± 0.2V.

5. Selec **FUNCTION** (2) to SINE. Adjust R132 (SINE DC) to let DC offset be DC 0V ± 10mV. Adjust R133 (SINE AMPL) to let the Vp-p of sine wave be 20.8V ± 0.2V.

6. Selec **FUNCTION** (2) to SQUARE. Adjust R128 to let the upper level of square wave be +10.4V ± 0.1V. Adjust R129 to let the lower level of square wave be -10.4V ± 0.1V.

7. Press the **FUNC/COUNT** switch (9) in. Connect a 10MHz ± 1PPM standard frequency to the **COUNTER** input (10). Adjust trimmer capacitor C2 until the display reads 000.000 KHz ± 1 digits (Hz). (with OVFL LED lit). Set the **RANGE** switch (4) to 1 MHz. Apply a 100MHz 50mV signal to **COUNT** input (10). Adjust trimmer resistor R126 to let the display be stable.

TROUBLESHOOTING

If you are experiencing trouble with your Model TFG-8111 Digital Function Generator, follow the procedures below to find and correct the problem.

1. Power Supply

   A. Varify that the voltage selector switch (S1) is set correctly (115V or 230V) for your available power.

   B. Turn the **POWER** (1) on and using an voltmeter measure the voltages at the following points:

U3	pin 1	+ 9V ± 10%
U1	pin 1	+23V ± 10%
Q1	Collector.....	-23V ± 10%

   If not, check and repair the components from the line cord to test points.

   C. Measure the voltages at the following points:

U3	pin 3	+ 5V ± 5%
U1	pin 3	+15V ± 5%
Q1	Emitter	-15V ± 5%
Q2	Emitter	- 5V ± 5%

U2 pin 3 ..... + 5V ± 5%

If not, check and repair the components of U1, U2, U3, U4, Q1 and Q2.

2. Counter Amplifier

Set the RANGE switch (4) to 1M. Push FUNC/COUNT (9) in and the DISPLAY (11) will blank out. Apply a 1MHz 25mV signal to COUNTER INPUT (10). Using an oscilloscope, trace this signal at the following points:

Q3	source	1 MHz	∿	55mVp-p ± 20%
Q4	collector	1 MHz	∿	150mVp-p ± 20%
U5	pin 7	1 MHz	∿	750mVp-p ± 20%
	pin 2	1 MHz	⎍	1 Vp-p ± 20%
	pin15	1 MHz	⎍	1 Vp-p ± 20%
Q6	collector	1 MHz	⎍	1.8 Vp-p ± 20%
U16	pin 3	1 MHz	⎍	1.8 Vp-p ± 20%
	pin 1	1 MHz	⎍	3 Vp-p ± 20%
	pin 4	1 MHz	⎍	3.5 Vp-p ± 20%

If not, check and repair the components of Q3, Q4, Q5, Q6 and U16.

3. Counter Control Circuit

Refer to circuit diagram sheet 4.

The counters gate time were selected by RANGE/GATE switches (4). If there occurrs functional error, check and repair U13, U14 or nearby components.

4. Tuning Amplifier and Constant Current Source

A. Turn the frequency control **MAIN** and **FINE** (3) to CCW (minimum) position. Check the voltage ratings of the following points:

U8	pin7	+10V ± 10%
U8	pin1	0V ± 10mV
U7	pin3	-15V (equals to -Vcc)
U9	pin2	+15V (equals to +Vcc)
U10	pin2	-15V (equals to -Vcc)

B. Turn the frequency control **MAIN** and **FINE** (3) to CW (maximum) position. Check the voltage ratings of the following points:

U8	pin7	+10V ± 10%
U8	pin1	+10V ± 10%
U7	pin3	- 5V ± 10%
U9	pin2	+ 5V ± 10%
U10	pin2	- 5V ± 10%

If not, check and repair the components of U8, U6, Q7, U7, Q8, U9, U10, Q9 and Q10.

5. Triangle Buffer and Comparator

Set the **RANGE** switch (4) to 1 KHz. Turn the **AMPLITUDE** (1) to CW location.

Check and be sure that the waveform and voltage of the following points:

Q13	Base	∿	2Vp-p ± 10%
U11	pin4	⎍	4.5Vp-p ± 10%
	pin9	⎍	3.5Vp-p ± 10%

If not, check and repair Q11, Q13, Q14 and U11.

6. **Sine Shaper and PRE Amplifier**

Check and be sure that the waveform and voltage of the following points:

TP1		∿	2Vp-p ± 10%
Q15	Base	∿	0.6Vp-p ± 10%
R87	(each side)	∿	2Vp-p ± 10%

If not, check and repair CR16 to CR31 or Q15 to Q19.

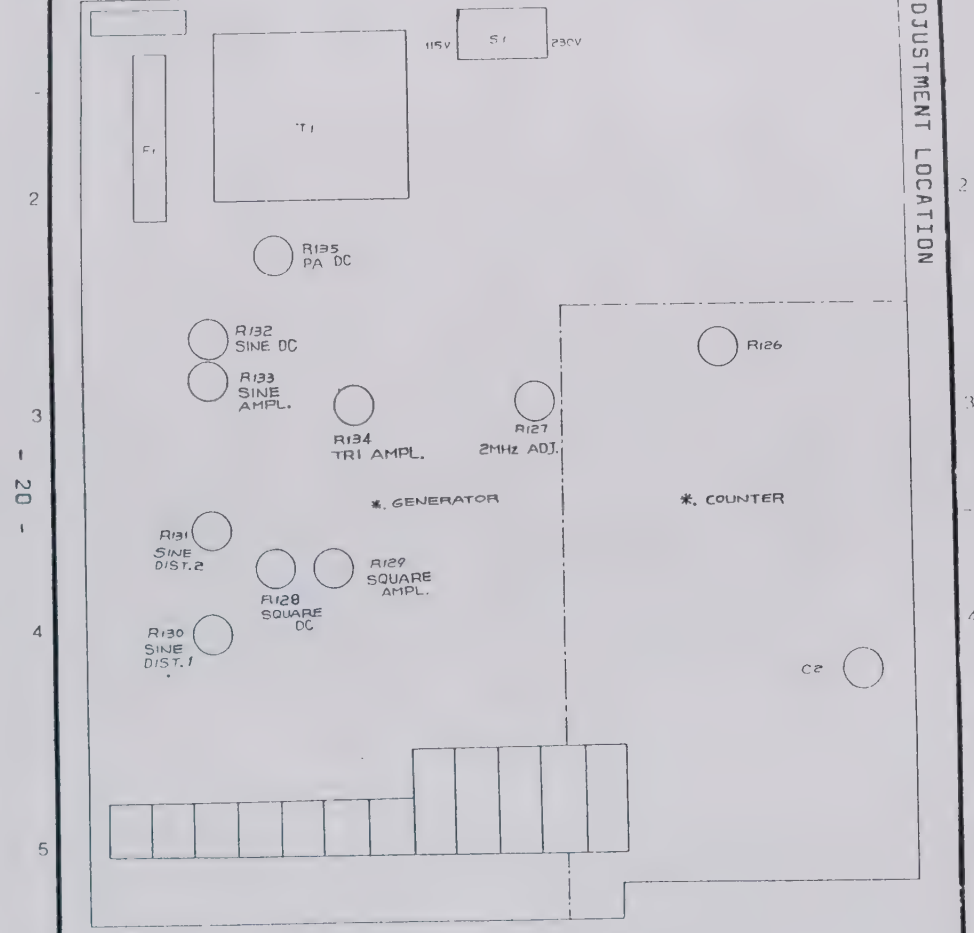
7. **Power Amplifier**

Set the **FUNCTION** switch (2) to sine wave. Check and be sure the waveform and voltage of the following points:

Q20	Base	∿	2Vp-p ± 10%
R103	(each side)	∿	20.8Vp-p ± 10%

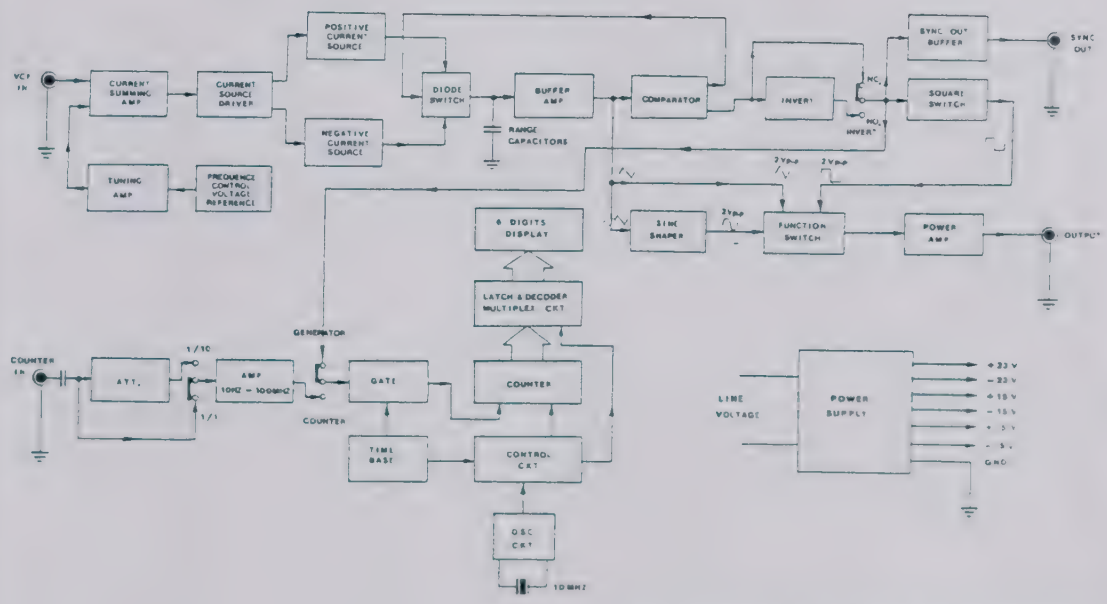
If not, check and repair Q20 to Q24.

REVISION	DATE



DO NOT SCALE THIS DRAWING	TOLERANCE UNLESS SPECIFIER ARE ANGLES DECIMALS	TFG-8111 ADJUSTMENT LOCATION
TOPWARD ELECTRIC INSTRUMENTS CO., LTD	DRAFTER Q.Q.Huang	DRAWING NO: DESIGNER / APPROVED

BLOCK DIAGRAM



CIRCUIT DIAGRAM

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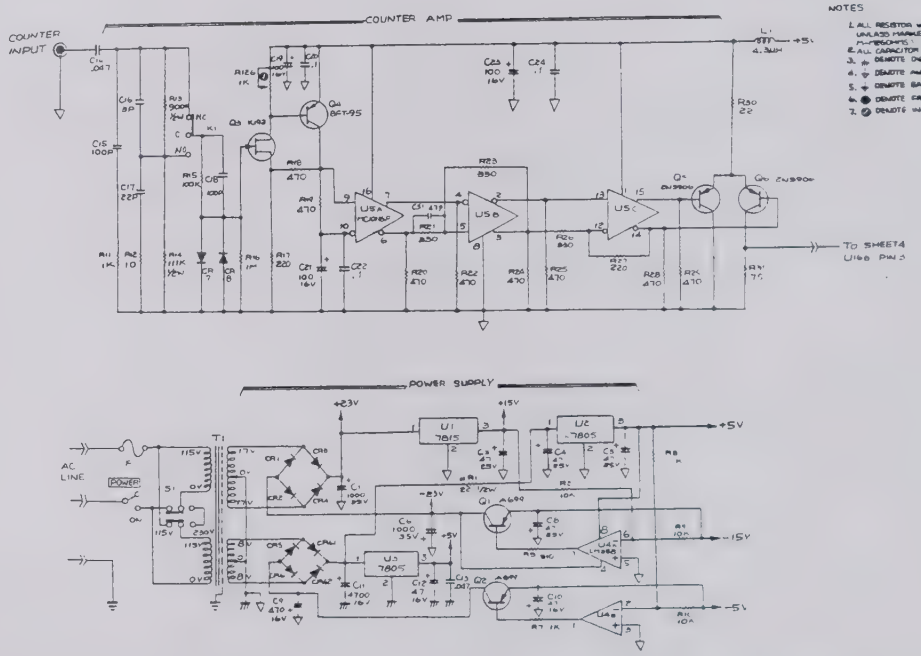
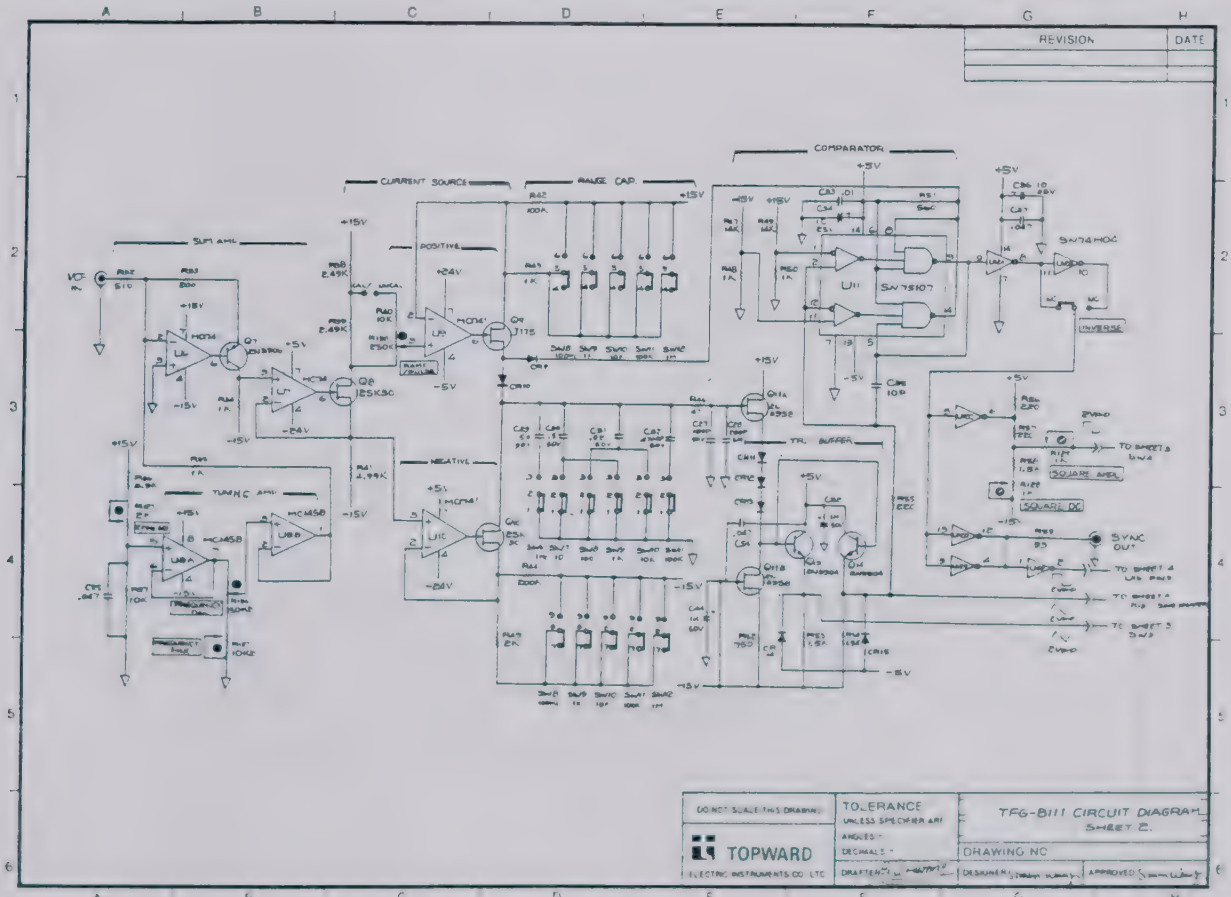


DO NOT SCALE THIS DRAWING	TOLERANCE UNLESS SPECIFIED ARE ANGLES DECIMAL	TFG-811 CIRCUIT DIAGRAM SHEET 1
TOPWARD ELECTRIC INSTRUMENTS CO. LTD	DRAFTER/19	DRAWING NO
	DESIGNER S.Simon Wong	APPROVED Simon Wong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SN75107
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MC1741
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TO SHEET 4 DWG
TO SHEET 5 DWG
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TFG-8111 CIRCUIT DIAGRAM
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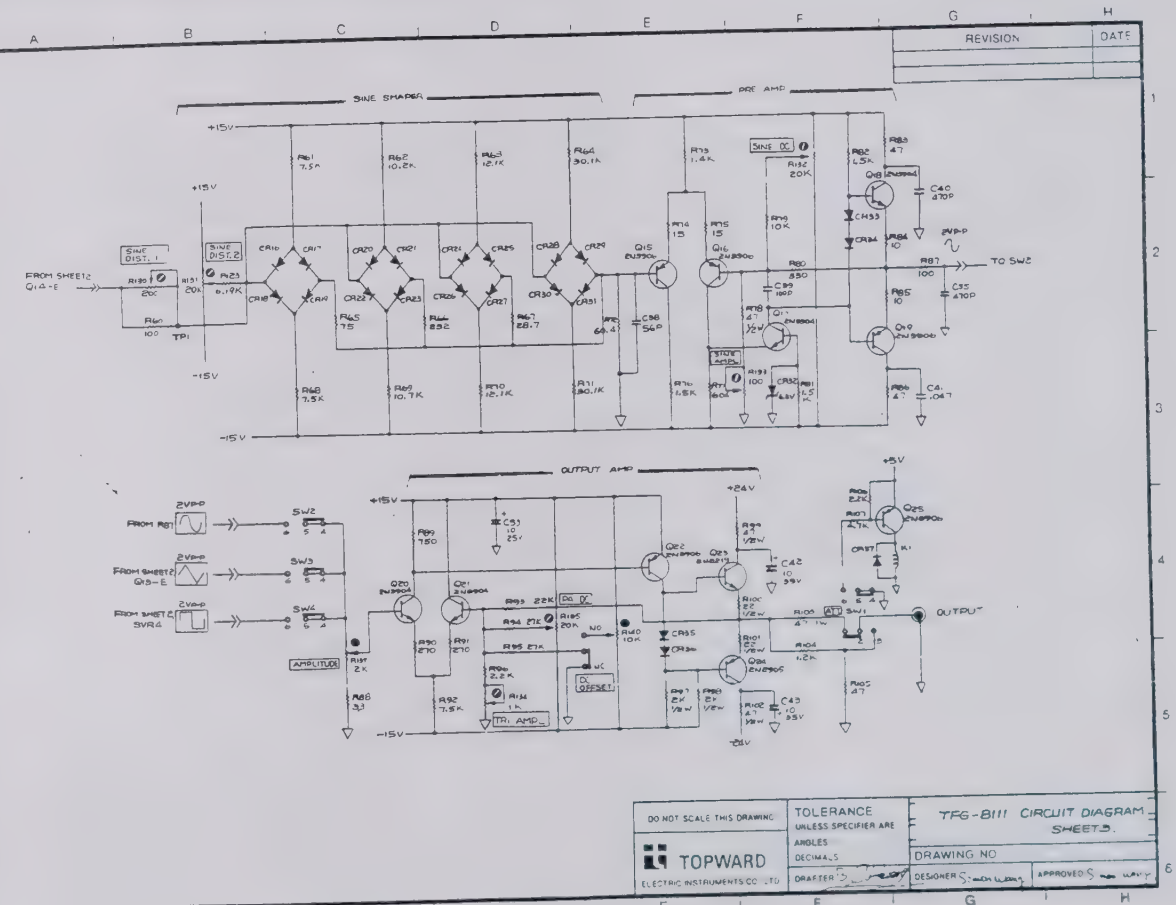
SINE SHAPER
PRE AMP
OUTPUT AMP
+15V
-15V
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-24V
+5V
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FROM SHEET2 Q14-E
TO SW2
FROM R81
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DC OFFSET
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TFG-8111 CIRCUIT DIAGRAM SHEET 3.
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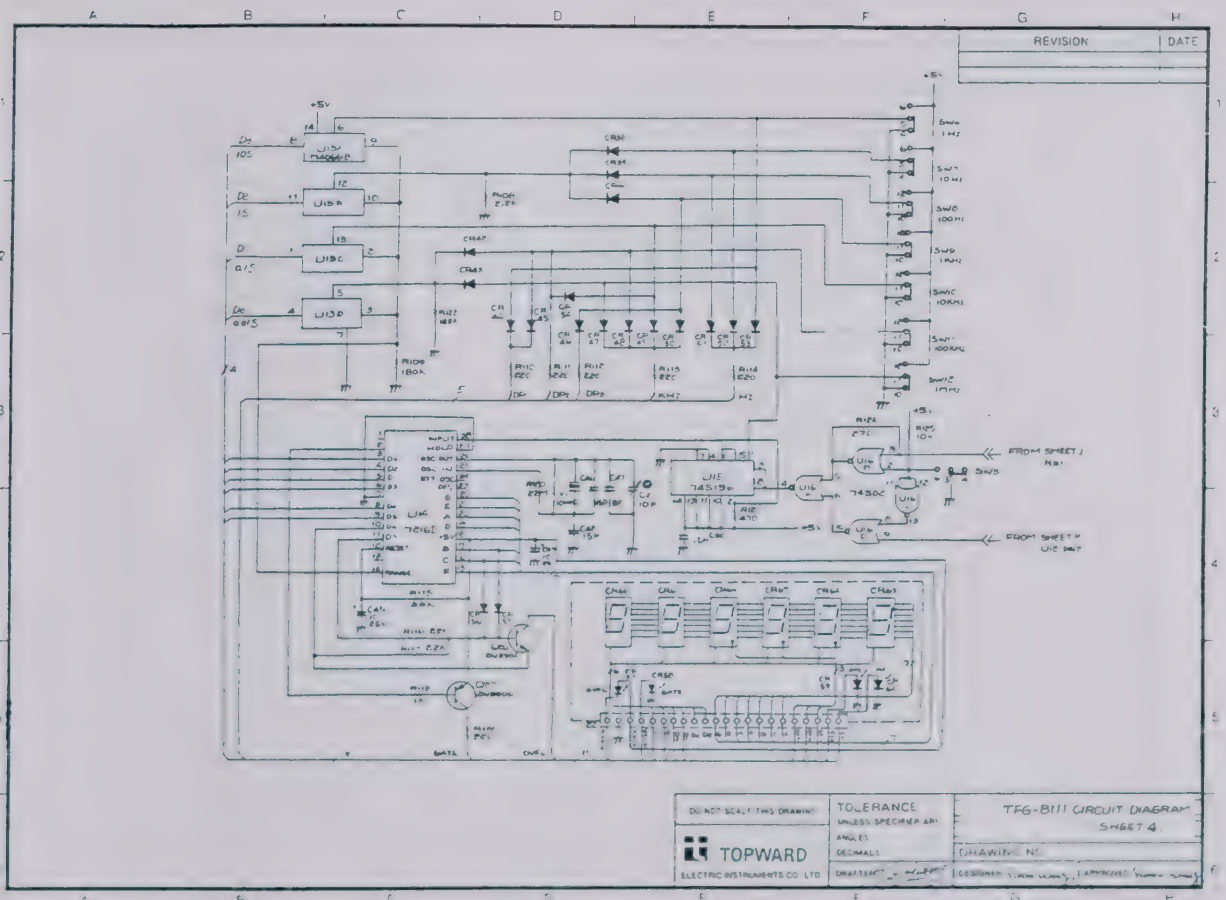
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TFG-8111 CIRCUIT DIAGRAM
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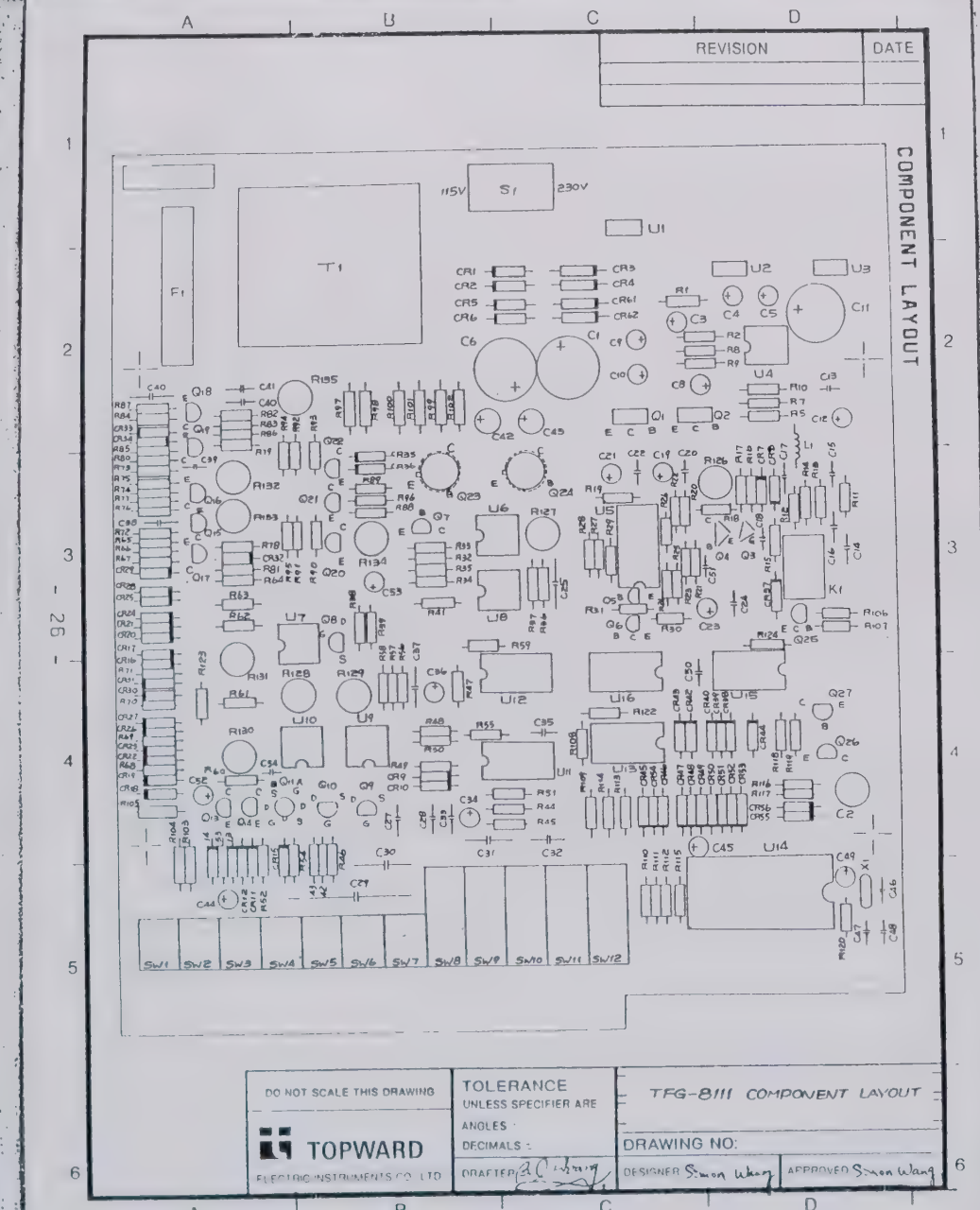
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COMPONENT LAYOUT
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U8
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U11
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DECIMALS :
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TFG-8111 COMPONENT LAYOUT
DRAWING NO:
DESIGNER Simon Wang
APPROVED Simon Wang

SPECIFICATIONS

GENERATOR

Waveforms:	Sine, Square, Triangle, Pulse, Ramp
Frequency:	0.1Hz - 2MHz, 7 Ranges
Display:	6 Digits with Hz, KHz, Gate, OVFL
Freq. Error:	Counter Accuracy
Output Impedance:	50Ω ±10%
Output Level:	5mVp-p (min) to 20Vp-p Continuously Variable (open circuit)
Attenuator:	0dB, -30dB
DC Offset:	±10 Volts Continuously Variable (open circuit)
Duty Cycle:	5% - 95% Continuously Variable with 50% Calibrated Switch
Distortion:	< 1%, 1Hz - 100KHz
Triangle Linearity:	< 1%, 1Hz - 100KHz
Rise/Fall Time:	< 100nS
Sync Out:	3Vp-p (open circuit), Tr < 25nS
VCF in:	0 - 5 Vdc Control Frequency to 1000:1

..... continue .....

COUNTER

Range:	10Hz - 100MHz
Gate Time:	0.01S, 0.1S, 1S, 10S Controlled by Range switch
Accuracy:	±(1 Count + Time Base Accuracy)
Sensitivity:	25mVrms(10Hz - 10MHz), 50mVrms(10Hz - 100MHz)
Attenuator:	0dB, -30dB
Max. Allowable Input:	150Vrms(DC + Peak AC)
Impedance:	1MΩ // 100pF
Time Base:	10MHz, ±10ppm (0°C - 40°C)
Display:	6 digits 7 segment LED display. LED Indicators for Gate, Overflow, Hz, KHz

GENERAL

Dimension:	233(W) x 80(H) x 300(D) mm
Weight:	1.6Kg
Power:	115V/230V ±10%, 50/60Hz, 12VA
Accessory:	Test Lead - ACS-003 BNC to Alligator Clip Cable 1 pcs

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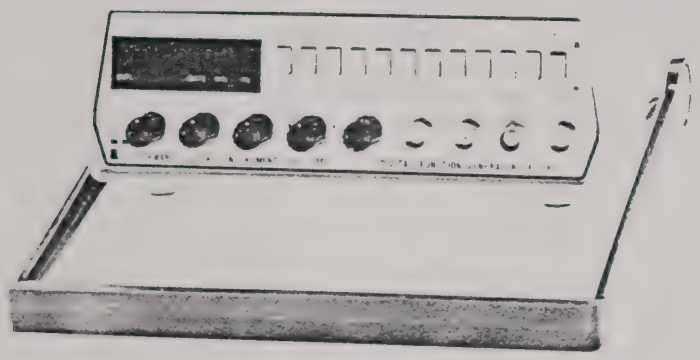

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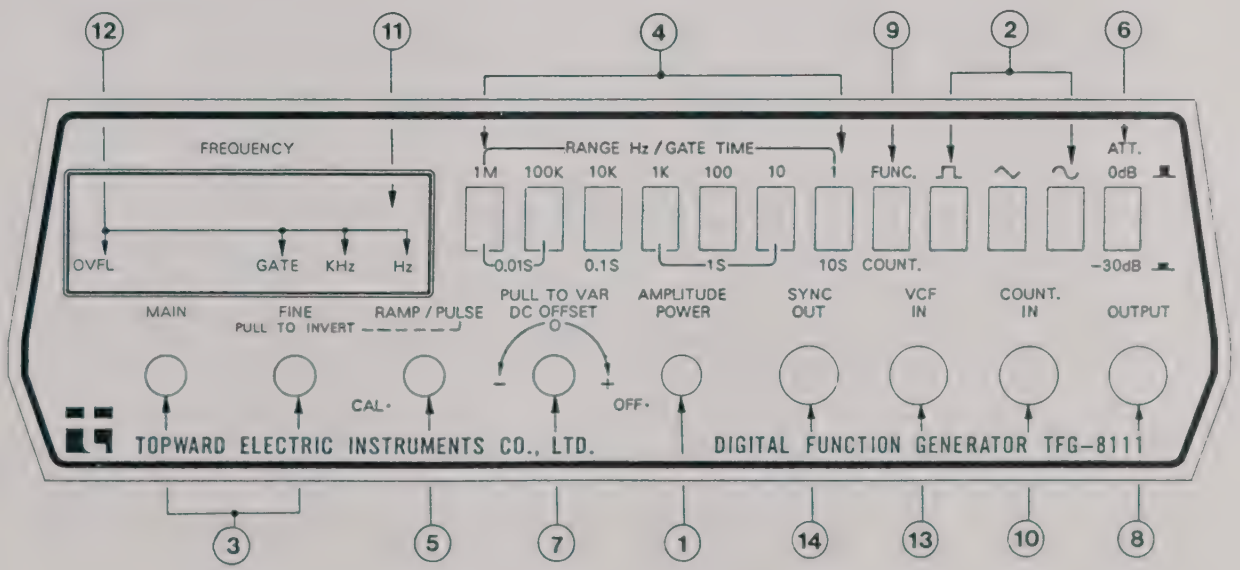
Figure - 1



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4. **RANGE/GATE TIME** - This bank of switches is used to select the frequency range produced. At the same time, the counter gate time is changed.

5. **RAMP/PULSE** - This knob is used to adjust the duty cycle of the Square or Triangle waveforms. When the knob is turned to CAL. (fully CCW position), the duty cycle is fixed at 50%. Otherwise, the duty cycle is adjustable between 5 to 95%.

6. **ATTENUATOR** - When this push button is out, the output/input signal is unchanged. If the switch is depressed, the Output/Input signal is reduced by 30 dB (Generator output / Counter input).

7. **DC OFFSET** - This knob allows a variable DC voltage between -10 V to +10 V to be added to the output signal. Note that the knob has to be pulled out for the offset to affect the signal. When the control is pushed in, no offset voltage is added.

8. **OUTPUT** - This connector provides the output signal for all waveforms.

9. **FUNC/COUNT** - When the switch is out, the 6 digits **DISPLAY** (11) shows the generator frequency. When the switch is in, the **DISPLAY** (11) shows the input frequency of counter.

10. **COUNTER IN** - This is the input connector for the 100MHz frequency counter. **FUNC/COUNT** switch (9) must be depressed.

11. **FREQUENCY DISPLAY** - This is a 6 digits LED display that shows the output frequency of the main generator or the input frequency of the counter.

12. **INDICATORS** - OVFL, GATE, KHz, Hz LEDs enunciate frequency overflow, gate time and frequency units in KHz, Hz.

13. **VCF IN** - This input is used to modulate the main frequency to 1000:1 with an external source of 0 - 5VDC.

14. **SYNC OUT** - This connector supplies a TTL compatible output signal which is unaffected by either the **FUNCTION** (2) or **AMPLITUDE** (1) controls. The output frequency is the same as that of **OUTPUT** signal (8).

OPERATING INSTRUCTIONS

1. **Instrument Turn-on**
   WARNING: Before applying power to your TFG-8111, make sure that the input voltage is set to your power source.

   A. Connect the TFG-8111 to an AC power source and turn on the POWER switch (1).

2. **Main Generator**
   A. Select the desired waveform using the FUNCTION switch (2). To generate a ramp or pulse output, turn on the RAMP/PULSE knob (5) and set the desired duty cycle.

   B. Set the desired frequency with the FREQUENCY control (3) and the RANGE switches (4).

   C. Adjust the output amplitude with the AMPLITUDE control (1) to the desired level. If a very small signal is required, depress the ATTENUATOR switch (6).

   D. Set DC Offset voltage with the DC OFFSET control (7).

   E. Use the SYNC output terminal (14) if TTL compatible level is required.

F. Pull out the **INVERT** switch (3) to introduce a 180 degree phase shift.

3. **Voltage Controlled Frequency**
   A. Supply a trim voltage between 0 and 5 VDC to the **VCF IN** terminal (13). The main frequency will be varied over 1000:1.

4. **Frequency Counter**
   A. Push in the **FUNC/COUNT** switch (9).

   B. Apply input signal to **COUNT IN** (10).

   C. Select **GATE TIME** (4) for best resolution.

   D. Use **ATTANUATOR** (6) for large input signal to avoid damage to the instrument.

OPERATING CAUTIONS

To assure operation within the published specifications, allow the unit to warm up and stabilize for at least 20 minutes.

Failure to observe the operating procedure listed below will result in damage to the unit and void your warranty.

Do not supply more than 10 Volts (AC + DC) into:

Output terminal (8)
VCF IN terminal (13)
SYNC terminal (14)

THEORY OF OPERATION

Counter Section

1. Counter Amplifier (refer to circuit diagram sheet 1)

   A. The buffer amplifier (Q3 and Q4) make up the impedance buffer circuit.

   B. U5A-U5C form a secondary high voltage gain stage. Q5 and Q6 form a level shifter.

2. Counter Control Circuit (refer to circuit diagram sheet 4)

   A. U14 (7216D) is a single chip counter IC. U13 and CR38-CR43 form a gate time selecting circuit.

   B. CR44-CR54 form a decimal point selecting circuit and Hz, KHz indicating circuit.

   C. U16A-U16D form a generator frequency display / counter input frequency display selecting circuit.

   D. U15 is a divide-by-ten IC, use for the high frequency input measurement.

Generator Section

1. Tuning Amplifier Summing Amplifier and Constant Current Source (refer to circuit diagram sheet 2)

A. The tuning amplifier is a non-inverting input amplifier (U8A), providing a fixed voltage for frequency control MAIN and FINE (3). U8B is a voltage buffer IC, buffering the variable control voltage of frequency control MAIN and FINE (3).

B. The summing amplifier (U6 and Q7) sums each current from the VCF input and the tuning amplifier output. The output voltage of the amplifier is a weighted average of the input signal voltages. The frequency control MAIN and FINE (3) varies the amount of voltage which determines the generator output frequency.

C. U7 and Q8 generate equalizing positive and negative voltages for the current source circuit. The current source circuit includes positive current source (U9 and Q9) and negative current source (U10 and Q10). The positive and negative current values are determined by frequency control MAIN and FINE (3).

2. Triangle Generator and Comparator (refer to circuit diagram sheet 2)

The triangle waveform from the triangle generator is apply to the voltage comparator which acts as an amplitude limiter. As the triangle waveform alternately crosses the upper and lower switching levels (refer to R47-R50) of the limiter input, a square wave is generated at the output of the voltage comparator (U11). The square is feedback to the triangle generator where it controls the charge / discharge cycle of the triangle output.

3. **Sine Shaper and PRE-Amplifier (refer to circuit diagram sheet 3)**

A. To obtain a sine wave. The triangle wave is shaped by a diode network (CR16 - CR31), in the sine shapper. There are four-stage diodes network serves as a non-linear load which varies the attenuation of the input triangle according to its level.

B. The PRE-Amplifier is a non-inverting closed loop amplifier. Q15 and Q16 form the differential input stage that provides DC stability. Q17 forms the second gain stage. Q18 and Q19 are the output buffer circuit.

4. **Output Amplifier (refer to circuit diagram sheet 3)**

The output amplifier works the same manner as PRE-Amplifier, and provides a 50 ohms low output impedance for **OUTPUT** terminal (8).

CALIBRATION

CAUTIONS: Services performed by unauthorized person will void your warranty.

To assure the most stable operation possible, your Model TFG-8111 should be periodically adjusted. To perform the following adjustment procedures, you will need a Phillips screwdriver, Timer/Counter, Voltmeter, an Oscilloscope (50MHz minimum), Distortion meter, and high frequency (up to 100MHz) signal generator. Calibration be performed under liboratory conditions having an ambient temperature of 18° to 28°C(62° to 82°F), and relative humidity of less then 80%. As you perform this procedure, please refer to the adjustment location drawing.

1. Set the TFG-8111 controls as follows:

RANGE (4)	1K
FUNCTION (2)	∿
DC OFFSET (7)	OFF
AMPLITUDE (1)	CW (Max.)
RAMP/PULSE (5)	CCW (CAL)
FREQUENCY MAIN & FINE (3)	CW (Max.)

2. Connector OUTPUT (8) on Counter TFC-1201 (or equivalent), adjust R127 (2MHz ADJ) to display 2.3KHz ± 50Hz.

3. Select **RANGE**(4) to 1 K and **FUNCTION** (2) to SINE. Set the **FREQUENCY MAIN & FINE** (3) to read 1KHz on TFC-1201. Connect the **OUTPUT** (8) to a distortion meter TDA-710 (or equivalent). Adjust R130 (SINE DIST1), R131 (SINE DIST2) for minimum distortion.

4. Select **FUNCTION** (2) to TRIANGLE. Turn the **AMPLITUDE** (1) to mid location. Connect the output to an voltmeter. Adjust R135 (PA DC) to be DC ± 10mV. Turn the **AMPLITUDE** (1) to maximum location. Connect the **OUTPUT** (8) to an oscilloscope. Adjust R134 (TRI AMPL) to let the Vp-p of triangle wave be 20 8V ± 0.2V.

5. Selec **FUNCTION** (2) to SINE. Adjust R132 (SINE DC) to let DC offset be DC 0V ± 10mV. Adjust R133 (SINE AMPL) to let the Vp-p of sine wave be 20.8V ± 0.2V.

6. Selec **FUNCTION** (2) to SQUARE. Adjust R128 to let the upper level of square wave be +10.4V ± 0.1V. Adjust R129 to let the lower level of square wave be -10.4V ± 0.1V.

7. Press the **FUNC/COUNT** switch (9) in. Connect a 10MHz ± 1PPM standard frequency to the **COUNTER** input (10). Adjust trimmer capacitor C2 until the display reads 000.000 KHz ± 1 digits (Hz). (with OVFL LED lit). Set the **RANGE** switch (4) to 1 MHz. Apply a 100MHz 50mV signal to **COUNT** input (10). Adjust trimmer resistor R126 to let the display be stable.

TROUBLESHOOTING

If you are experiencing trouble with your Model TFG-8111 Digital Function Generator, follow the procedures below to find and correct the problem.

1. Power Supply

A. Varify that the voltage selector switch (S1) is set correctly (115V or 230V) for your available power.

B. Turn the POWER (1) on and using an voltmeter measure the voltages at the following points:

U3 pin 1 ..... + 9V ± 10%
U1 pin 1 ..... +23V ± 10%
Q1 Collector..... -23V ± 10%

If not, check and repair the components from the line cord to test points.

C. Measure the voltages at the following points:

U3 pin 3 ..... + 5V ± 5%
U1 pin 3 ..... +15V ± 5%
Q1 Emitter ..... -15V ± 5%
Q2 Emitter ..... - 5V ± 5%

U2 pin 3 ..... + 5V ± 5%

If not, check and repair the components of U1, U2, U3, U4, Q1 and Q2.

2. Counter Amplifier

Set the RANGE switch (4) to 1M. Push FUNC/COUNT (9) in and the DISPLAY (11) will blank out. Apply a 1MHz 25mV signal to COUNTER INPUT (10). Using an oscilloscope, trace this signal at the following points:

Q3	source	1 MHz	∿	55mVp-p ± 20%
Q4	collector	1 MHz	∿	150mVp-p ± 20%
U5	pin 7	1 MHz	∿	750mVp-p ± 20%
	pin 2	1 MHz	⎍	1 Vp-p ± 20%
	pin15	1 MHz	⎍	1 Vp-p ± 20%
Q6	collector	1 MHz	⎍	1.8 Vp-p ± 20%
U16	pin 3	1 MHz	⎍	1.8 Vp-p ± 20%
	pin 1	1 MHz	⎍	3 Vp-p ± 20%
	pin 4	1 MHz	⎍	3.5 Vp-p ± 20%

If not, check and repair the components of Q3, Q4, Q5, Q6 and U16.

3. Counter Control Circuit

Refer to circuit diagram sheet 4.

The counters gate time were selected by RANGE/GATE switches (4). If there occurrs functional error, check and repair U13, U14 or nearby components.

4. Tuning **Amplifier and Constant Current Source**

A. Turn the frequency control **MAIN** and **FINE** (3) to CCW (minimum) position. Check the voltage ratings of the following points:

U8 pin7 ..... +10V ± 10%
U8 pin1 ..... 0V ± 10mV
U7 pin3 ..... -15V (equals to -Vcc)
U9 pin2 ..... +15V (equals to +Vcc)
U10 pin2 ..... -15V (equals to -Vcc)

B. Turn the frequency control **MAIN** and **FINE** (3) to CW (maximum) position. Check the voltage ratings of the following points:

U8 pin7 ..... +10V ± 10%
U8 pin1 ..... +10V ± 10%
U7 pin3 ..... - 5V ± 10%
U9 pin2 ..... + 5V ± 10%
U10 pin2 ..... - 5V ± 10%

If not, check and repair the components of U8, U6, Q7, U7, Q8, U9, U10, Q9 and Q10.

5. **Triangle Buffer and Comparator**

Set the **RANGE** switch (4) to 1 KHz. Turn the **AMPLITUDE** (1) to CW location.

Check and be sure that the waveform and voltage of the following points:

Q13	Base	∿	2Vp-p ± 10%
U11	pin4	⎍	4.5Vp-p ± 10%
	pin9	⎍	3.5Vp-p ± 10%

If not, check and repair Q11, Q13, Q14 and U11.

6. **Sine Shaper and PRE Amplifier**
Check and be sure that the waveform and voltage of the following points:

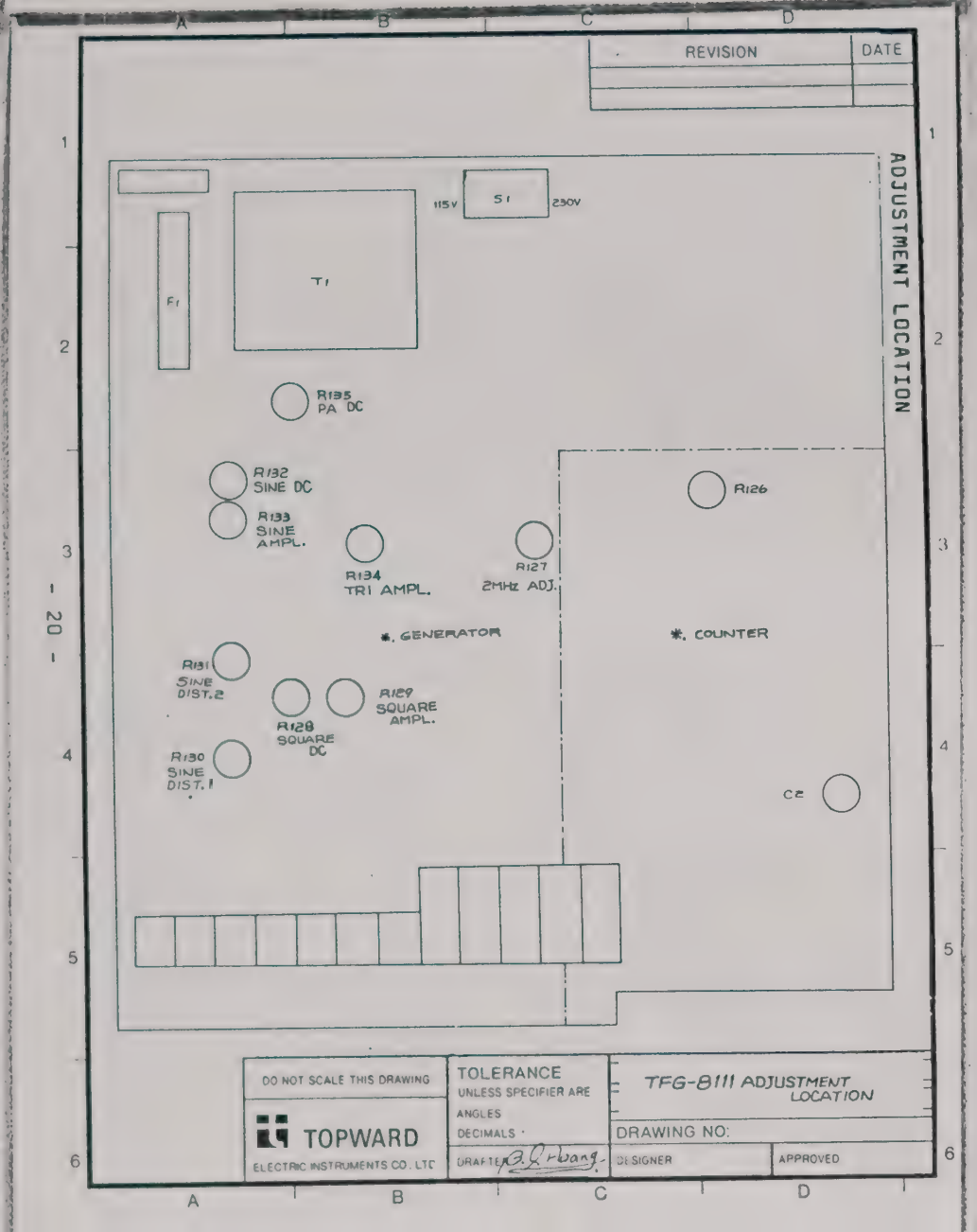
TP1	.....	∿	2Vp-p ± 10%
Q15	Base	∿	0.6Vp-p ± 10%
R87	(each side)	∿	2Vp-p ± 10%

If not, check and repair CR16 to CR31 or Q15 to Q19.

7. **Power Amplifier**
Set the FUNCTION switch (2) to sine wave. Check and be sure the waveform and voltage of the following points:

Q20	Base	∿	2Vp-p ± 10%
R103	(each side)	∿	20.8Vp-p ± 10%

If not, check and repair Q20 to Q24.


REVISION
DATE
ADJUSTMENT LOCATION
115V
S1
230V
T1
F1
R135
PA DC
R132
SINE DC
R133
SINE
AMPL.
R134
TRI AMPL.
R127
2MHz ADJ.
R126
*. GENERATOR
*. COUNTER
R131
SINE
DIST.2
R129
SQUARE
AMPL.
R128
SQUARE
DC
R130
SINE
DIST.1
C2
- 20 -
DO NOT SCALE THIS DRAWING
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ELECTRIC INSTRUMENTS CO. LTD
TOLERANCE
UNLESS SPECIFIER ARE
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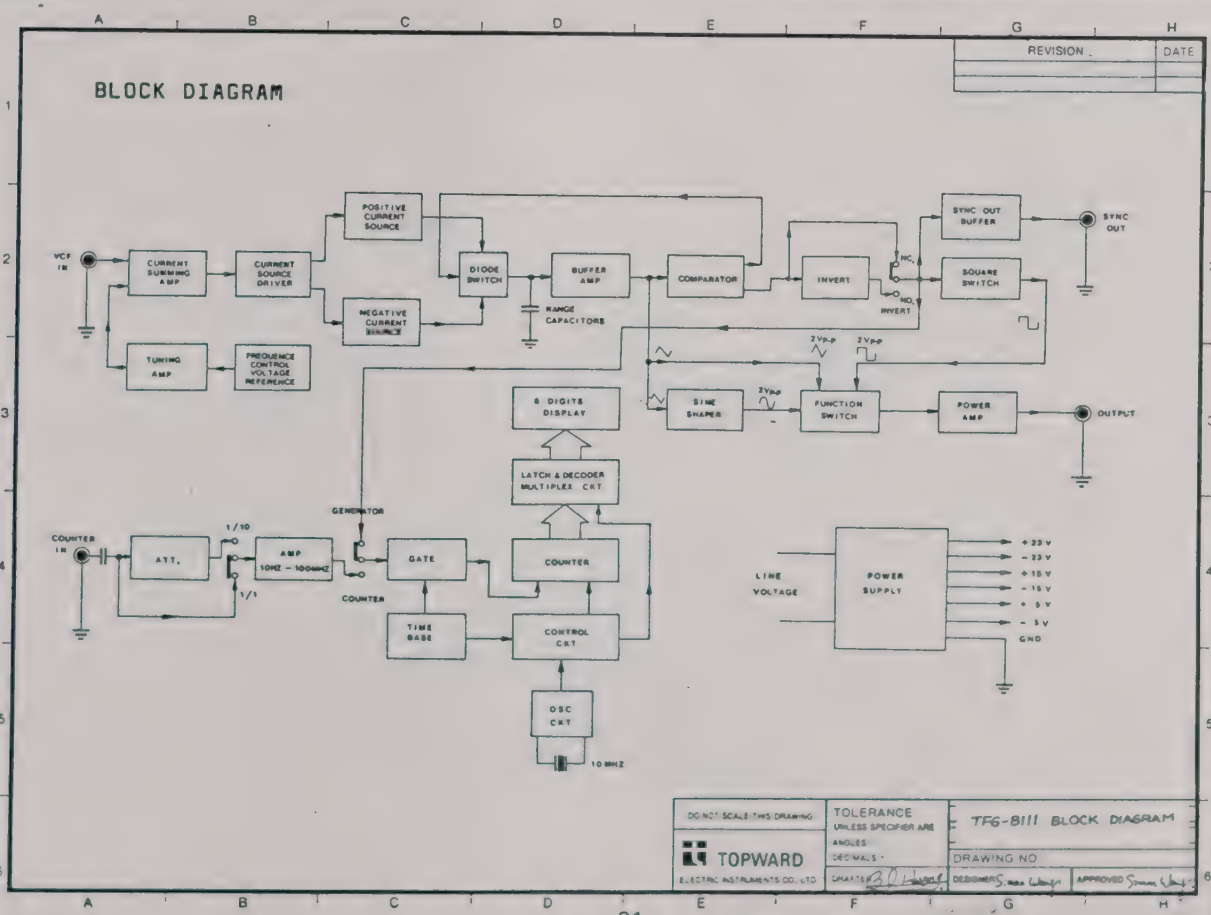
DRAFTER
DESIGNER
APPROVED
TFG-8111 ADJUSTMENT LOCATION
DRAWING NO:


BLOCK DIAGRAM
REVISION
DATE
VCF IN
CURRENT SUMMING AMP
CURRENT SOURCE DRIVER
POSITIVE CURRENT SOURCE
NEGATIVE CURRENT SOURCE
DIODE SWITCH
BUFFER AMP
COMPARATOR
INVERT
NC.
NO.
INVERT
SYNC OUT BUFFER
SYNC OUT
SQUARE SWITCH
RANGE CAPACITORS
TUNING AMP
FREQUENCE CONTROL VOLTAGE REFERENCE
2Vp-p
2Vp-p
2Vp-p
SINE SHAPER
FUNCTION SWITCH
POWER AMP
OUTPUT
8 DIGITS DISPLAY
LATCH & DECODER MULTIPLEX CKT
COUNTER IN
ATT.
1/10
1/1
AMP 10HZ ~ 100MHZ
GENERATOR
COUNTER
GATE
COUNTER
TIME BASE
CONTROL CKT
OSC CKT
10.0MHZ
LINE VOLTAGE
POWER SUPPLY
+ 23 V
- 23 V
+ 15 V
- 15 V
+ 5 V
- 5 V
GND
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UNLESS SPECIFIED ARE
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TFG-8111 BLOCK DIAGRAM
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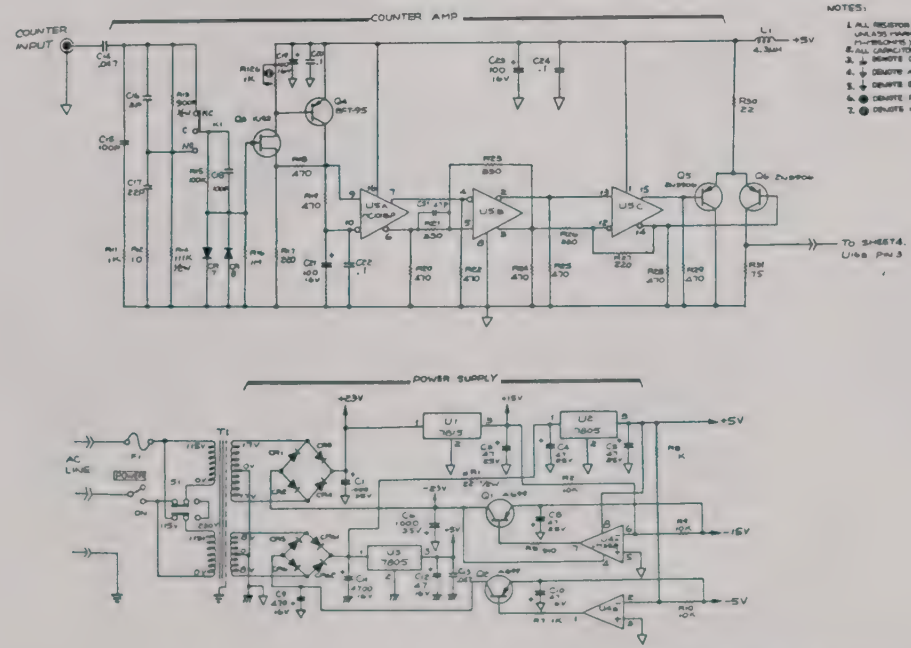
DESIGNED
APPROVED

CIRCUIT DIAGRAM



REVISION	DATE

DO NOT SCALE THIS DRAWING	TOLERANCE UNLESS SPECIFIED ARE ANGLES ° DECIMALS .x ±.1 .xx ±.01	TFG-8111 CIRCUIT DIAGRAM SHEET 1
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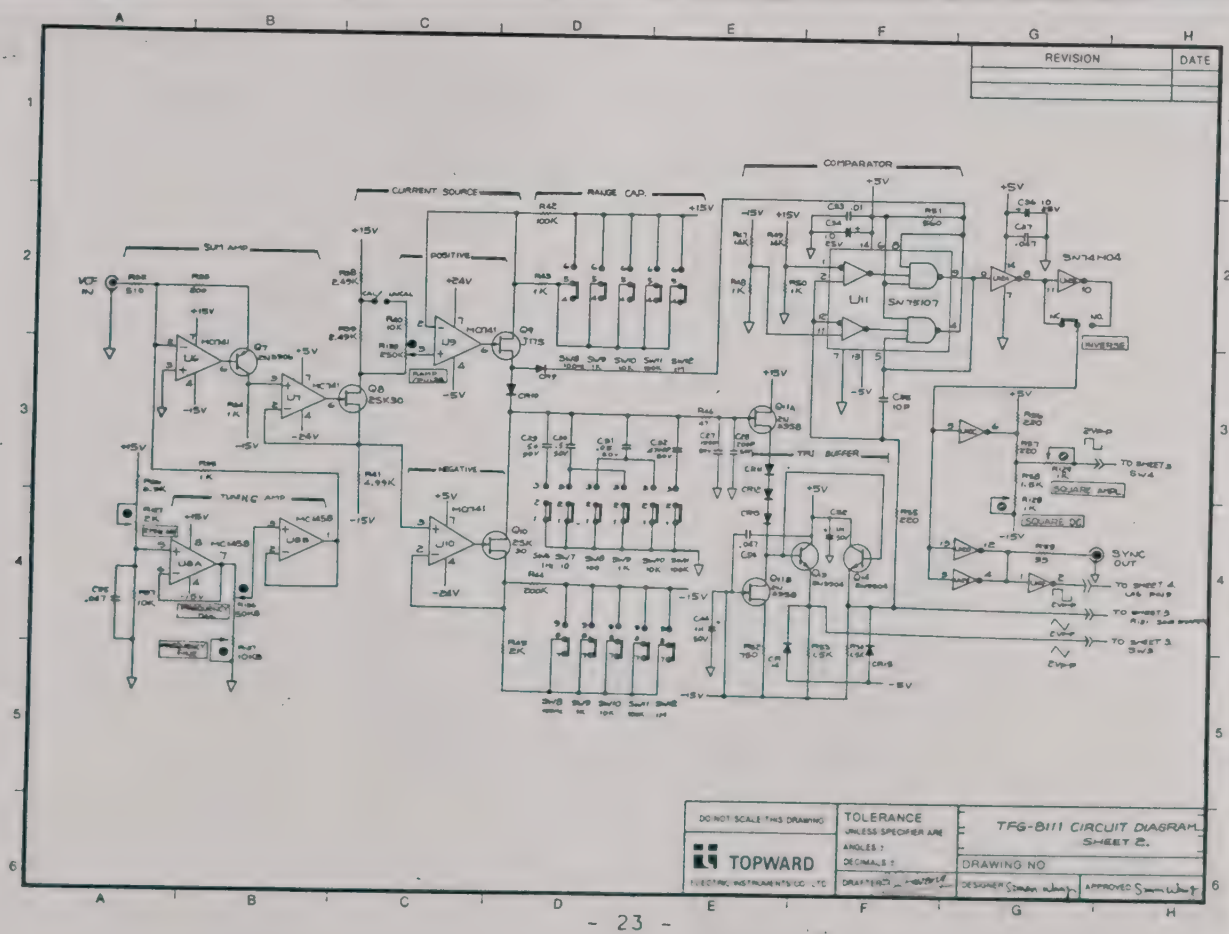
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DATE
SUM AMP
CURRENT SOURCE
RANGE CAP.
COMPARATOR
POSITIVE
NEGATIVE
TUNING AMP
TRU BUFFER
SQUARE AMPL
SQUARE DC
SYNC OUT
INVERSE
TO SHEET 3 SW4
TO SHEET 4 U6 PIN 9
TO SHEET 3 R.D. SIGNAL
TO SHEET 3 SW3
TOPWARD
ELECTRONIC INSTRUMENTS CO. LTD.
DO NOT SCALE THIS DRAWING
TOLERANCE
UNLESS SPECIFIED ARE
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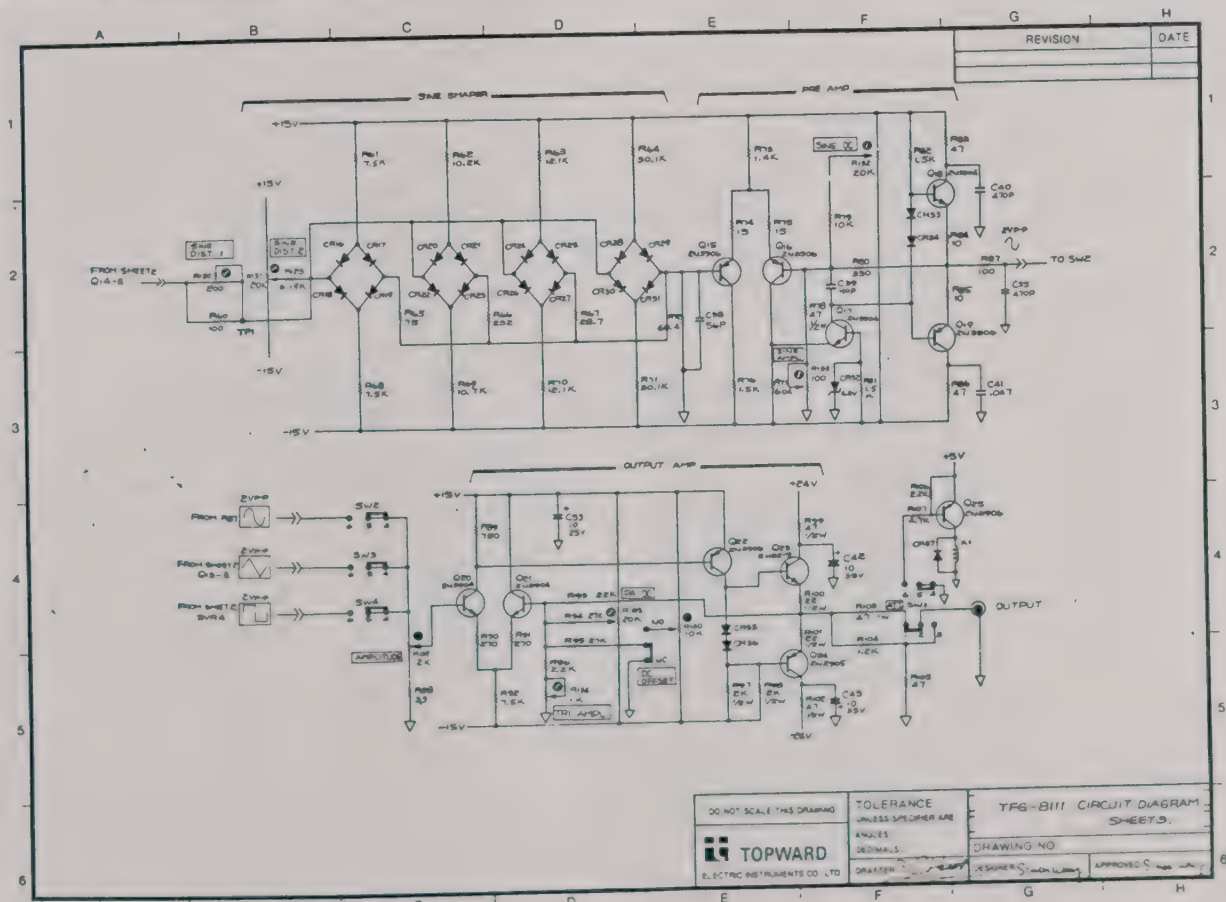
TFG-8111 CIRCUIT DIAGRAM
SHEET 2.
DRAWING NO


REVISION
DATE
SINE SHAPER
PRE AMP
OUTPUT AMP
+15V
-15V
+24V
-24V
+5V
FROM SHEET 6
TO SWE
OUTPUT
DO NOT SCALE THIS DRAWING
TOLERANCE
UNLESS SPECIFIED ARE
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ELECTRIC INSTRUMENTS CO. LTD
TFG-8111 CIRCUIT DIAGRAM
SHEET 3.
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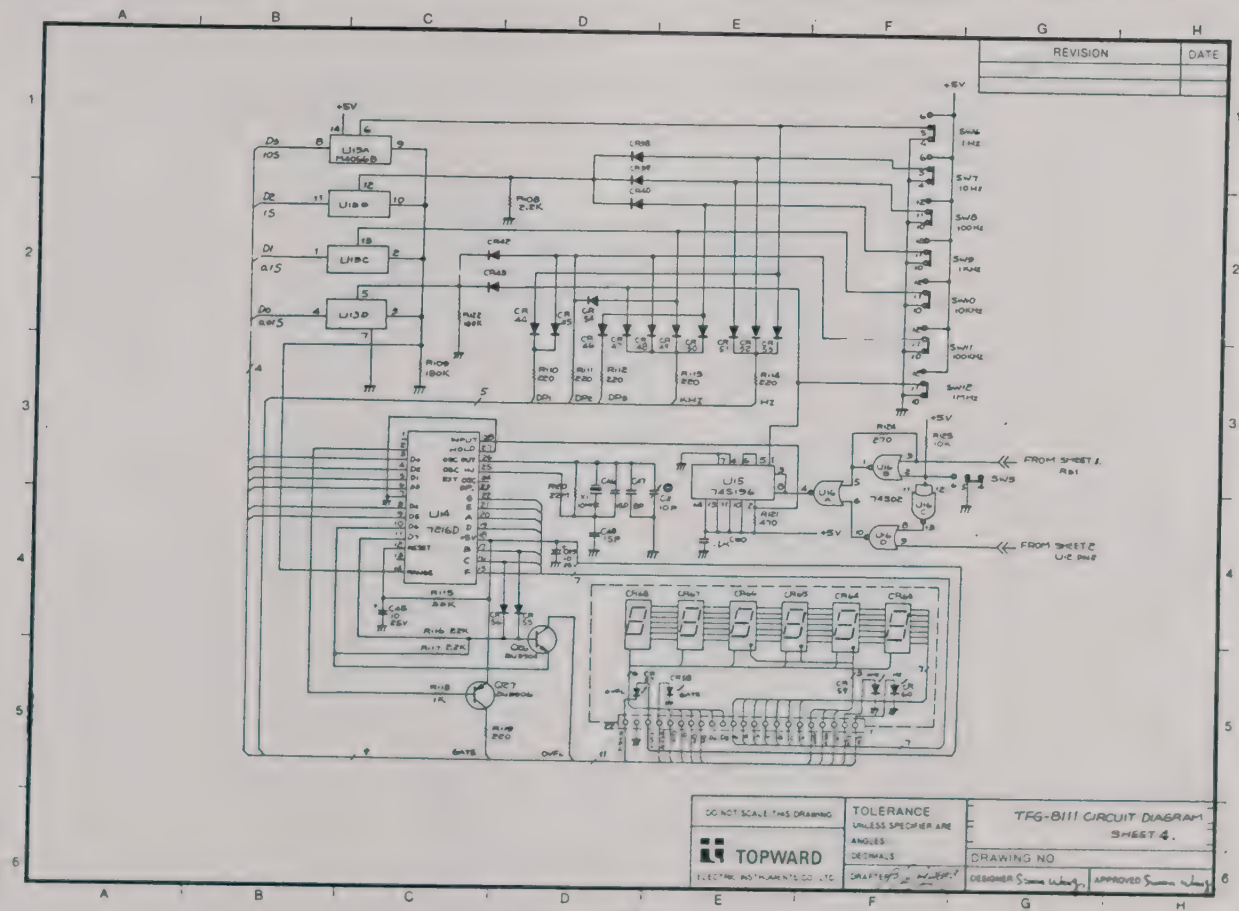
REVISION
DATE
+5V
U13A M4066B
U13B
U13C
U13D
U14 7216D
U15 74S196
74S00
FROM SHEET 1.
FROM SHEET 2.
SW4 1MHz
SW7 10MHz
SW8 100MHz
SW9 1MHz
SW10 10KHz
SW11 100KHz
SW12 1MHz
DO NOT SCALE THIS DRAWING
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UNLESS SPECIFIED ARE
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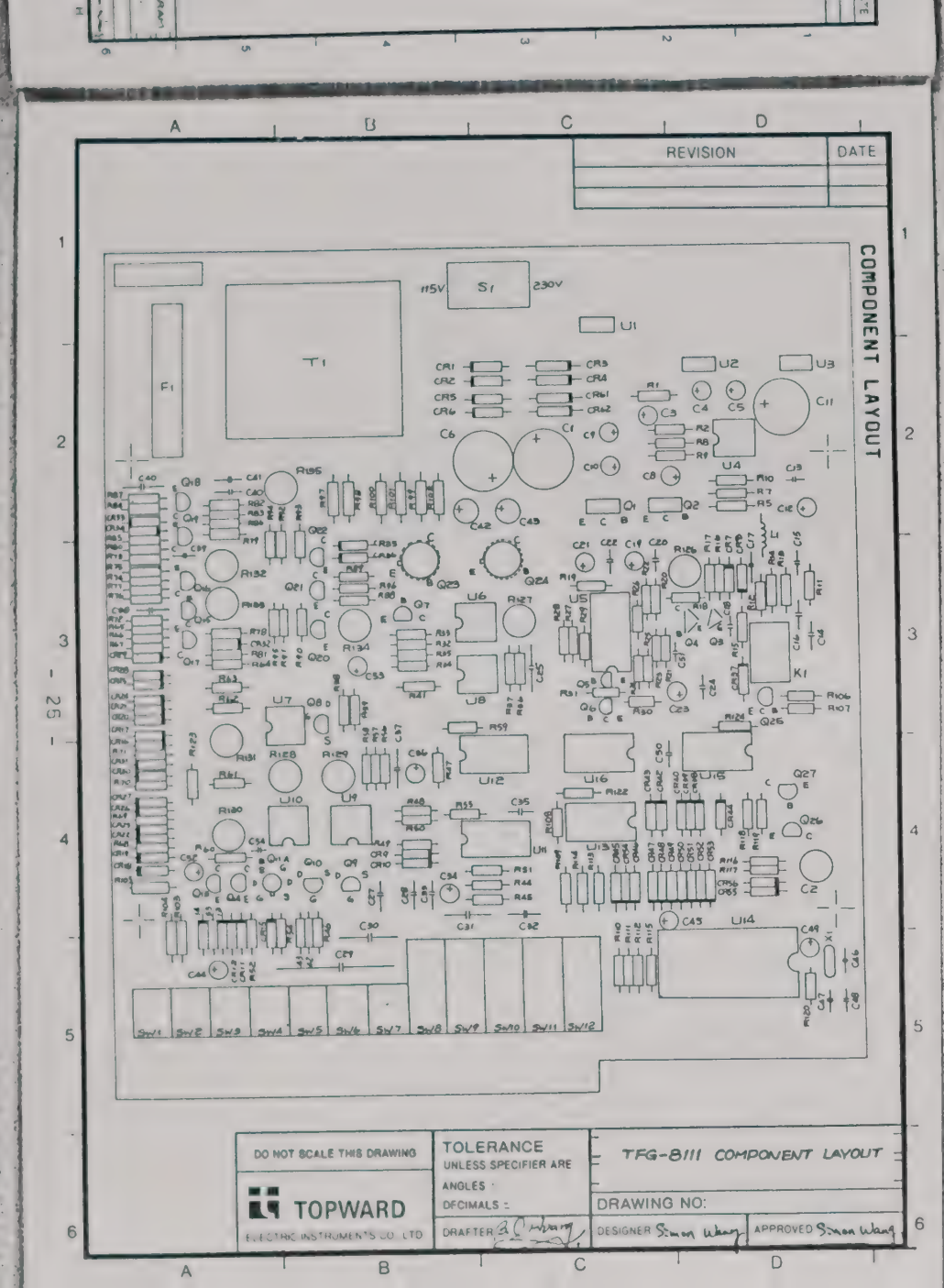
DECIMALS
TOPWARD
ELECTRONIC INSTRUMENTS CO. LTD.
TFG-8111 CIRCUIT DIAGRAM
SHEET 4.
DRAWING NO
DESIGNED
APPROVED


REVISION
DATE
COMPONENT LAYOUT
S1
115V
230V
T1
F1
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
K1
L1
X1
SW1
SW2
SW3
SW4
SW5
SW6
SW7
SW8
SW9
SW10
SW11
SW12
DO NOT SCALE THIS DRAWING
TOPWARD
ELECTRIC INSTRUMENTS CO. LTD
TOLERANCE
UNLESS SPECIFIER ARE
ANGLES :
DECIMALS :
DRAFTER
TFG-8111 COMPONENT LAYOUT
DRAWING NO:
DESIGNER Simon Wang
APPROVED Simon Wang

SPECIFICATIONS

GENERATOR

Waveforms:	Sine, Square, Triangle, Pulse, Ramp
Frequency:	0.1Hz - 2MHz, 7 Ranges
Display:	6 Digits with Hz, KHz, Gate, OVFL
Freq. Error:	Counter Accuracy
Output Impedance:	50Ω ±10%
Output Level:	5mVp-p (min) to 20Vp-p Continuously Variable (open circuit)
Attenuator:	0dB, -30dB
DC Offset:	±10 Volts Continuously Variable (open circuit)
Duty Cycle:	5% - 95% Continuously Variable with 50% Calibrated Switch
Distortion:	< 1%, 1Hz - 100KHz
Triangle Linearity:	< 1%, 1Hz - 100KHz
Rise/Fall Time:	< 100nS
Sync Out:	3Vp-p (open circuit), Tr < 25nS
VCF in:	0 - 5 Vdc Control Frequency to 1000:1

..... continue .....

COUNTER

Range:	10Hz - 100MHz
Gate Time:	0.01S, 0.1S, 1S, 10S Controlled by Range switch
Accuracy:	±(1 Count + Time Base Accuracy)
Sensitivity:	25mVrms(10Hz - 10MHz), 50mVrms(10Hz - 100MHz)
Attenuator:	0dB, -30dB
Max. Allowable Input:	150Vrms(DC + Peak AC)
Impedance:	1MΩ // 100pF
Time Base:	10MHz, ±10ppm (0°C - 40°C)
Display:	6 digits 7 segment LED display. LED Indicators for Gate, Overflow, Hz, KHz

GENERAL

Dimension:	233(W) x 80(H) x 300(D) mm
Weight:	1.6Kg
Power:	115V/230V ±10%, 50/60Hz, 12VA
Accessory:	Test Lead - ACS-003 BNC to Alligator Clip Cable 1 pcs

MP MASTER
MA25769